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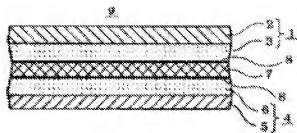
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(54) BATTERY ADHESIVE AND BATTERY USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To increase adhesion between an electrode and a separator as well as a battery discharge characteristic over a wide range of temperature by heating, cross-link polymerizing and hardening an organic vinyl compound containing two or more vinyl groups in a single molecule.

SOLUTION: A battery is manufactured, so as to have an electrode laminate 9 with a separator 7 bonded for holding an electrolyte between a positive electrode 1 with a positive electrode active material layer 3 bonded to a positive electrode current collector 2, and a negative electrode 4 with a negative electrode active material layer 6 bonded to a negative electrode current collector 5. Also, an adhesive 8 for bonding the electrodes 1 and 4, and the separator 7 contains an organic vinyl compound containing two or more vinyl groups in one molecule. As a result, an adhesive even with a high ionic conductivity to form a battery body having good electrical contact between an electrode and an electrolytic layer over a wide temperature range can be provided without using a sturdy outer can for applying external pressure.



JAPANESE

[JP,10-289732,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

* NOTICES *

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- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the rechargeable battery used, for example for a portable electronic device etc. It is related with the cell using the adhesives for cells and it which can manufacture the rechargeable battery of arbitrary form, such as a thin shape, in detail.

[0002]

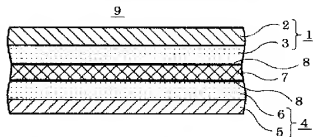
[Description of the Prior Art]Although the request to the small size and the weight saving of a portable electronic device is dramatically large, for the realization, cell development various now and improvement are advanced indispensably [the improved efficiency of a cell, and a miniaturization] therefore. The characteristics demanded of the cell are high tension, high energy density, reliability, the optionality of form, etc. A lithium ion battery is a rechargeable battery with which it is expected that high tension and high energy density will be most realized in an old cell. The improvement is advanced briskly even now.

[0003]A lithium ion battery has an ionic conduction layer inserted into the electrode and this electrode of a couple of a cathode and an anode as that main component. In the lithium ion battery used now, what applied powder, such as a lithium cobalt multiple oxide as an active material, to the cathode at the charge collector, and was made tabular, and the thing which applied the powder of the carbon system material to the anode as an active material at the charge collector, and was made tabular are used. About an ionic conduction layer, the separator which is a porosity film which consists of polyethylene, polypropylene, etc. is inserted, and what was filled with the electrolysis solution of the non-drainage system is used.

[0004]As shown, for example in JP,H8-83608,A in the conventional lithium ion battery, in order to maintain the electric interengagement of the

Drawing selection

Representative draw



- | | |
|-------------|------------------|
| 1 : 正極 | 6 : 負極活性物質層 |
| 2 : 正極集電体 | 7 : セパレータ (電解質層) |
| 3 : 正極活性物質層 | 8 : 接着剤 |
| 4 : 負極 | 9 : 電極積層体 |
| 5 : 負極集電体 | |

[Translation done.]

field of a cathode, a separator, and an anode and a separator, It is necessary to maintain the contact within all the fields by giving these a pressure from the exterior with firm armor cans, such as metal.

[0005]The manufacturing method which unifies a cell is shown by by carrying out heating binding of the layer of an ion-conductive solid electrolyte, and the layer of an electrode material with a thermoplastic resin binding agent in the example of the solid secondary battery indicated, for example to JP.H5-159802,A. In this case, since electric interengagement is maintained by unifying an electrode and a solid electrolyte layer, even if it does not apply a pressure from the exterior, it works as a cell. Furthermore, about the thin cell, what used polymer gel for the ion conductor is known as indicated in the U.S. Pat. No. 5,460,904 item, but. By using the binding agent which consists of polyvinylidene fluorides as polymer gel in this thin cell, it has been the feature to make a cathode, a separator, and an anode unify.

[0006]

[Problem to be solved by the invention]Since the conventional cell is constituted as mentioned above, in order to fully contact an electrode and an ionic conduction layer electrically, The firm armor can made with the metal etc. on which a pressure can be put from the exterior had to be used, as a result, the rate that the armor can in the volume of a cell and weight which is except a power generation part occupies became large, and there was a problem of being disadvantageous to form a cell with a high energy density.

[0007]In the cell which joined the solid electrolyte layer to the electrode with the binding agent, since the electrode-electrolyte interface is covered with the solid binding agent, compared with the cell of the type on which a pressure is put from the exterior with an armor can, for example using the above-mentioned liquid electrolyte, it is disadvantageous from an ion-conductive viewpoint. When a binding agent is used, generally a liquid electrolyte and the binding agent which has the ion conductivity more than equivalent are not found out, and cannot obtain a battery characteristic equivalent to the cell using a liquid electrolyte.

[0008]In the thin cell using polyvinylidene fluoride as polymer gel, since polyvinylidene fluoride has thermoplasticity, the adhesive strength is easily influenced by temperature and there is a fault to which adhesive strength especially falls in the time of an elevated temperature.

[0009]Are made in order that this invention may solve the above problems, and by junction to an electrode and an electrolyte layer (separator). The adhesives which have the good ionic conductivity for making the battery body which has the good electric interengagement between electrode-electrolyte layers in a wide temperature requirement form, without using the firm armor can for giving a pressure from the exterior, It aims at obtaining a thin shape and the cell in which it was lightweight, and was reliable and the cell charging and discharging characteristic was excellent with these adhesives.

[0010]

[Means for solving problem]Invention concerning Claim 1 is adhesives for cells which paste up the active material layer pasted up on the charge collector on a separator, and these adhesives are the adhesives for cells containing at least one kind of organic vinyl compound which contains two or more vinyl groups in one molecule.

[0011]The organic vinyl compound in which invention concerning Claim 2 contains two or more vinyl groups in one molecule in the adhesives for cells according to claim 1 is acrylic ester, polyacrylic ester, methacrylic acid ester, or polymethacrylic acid ester.

[0012]Invention concerning Claim 3 mixes at least one kind of organic vinyl compound which contains one vinyl group in adhesives in one molecule in the adhesives for cells according to claim 1 or 2.

[0013]Invention concerning Claim 4 mixes a reaction catalyst in the adhesives for cells according to any one of claims 1 to 3 to the organic vinyl compound which contains two or more vinyl groups in one molecule.

[0014]Invention concerning Claim 5 mixes lithium salt and an aprotic organic solvent in adhesives in the adhesives for cells according to any one of claims 1 to 4.

[0015]Invention concerning Claim 6 is a cell which has an electrode layered product which pastes up the active material layer side of the electrode of the couple which pasted up the active material layer on the charge collector, and a separator using the adhesives for cells according to any one of claims 1 to 5.

[0016]In the cell according to claim 6, bond strength of an active material layer and a separator of invention concerning Claim 7 is more than equivalent compared with bond strength of an active material layer and a charge collector.

[0017]Invention concerning Claim 8 is provided with two or more layers of an electrode layered product in the cell according to claim 6 or 7.

[0018]Invention concerning Claim 9 is formed in the cell according to claim 8 by arranging by turns among two or more separators with which a cathode and an anode were separated.

[0019]In the cell according to claim 8, invention concerning Claim 10 is formed, when two or more layers of an electrode layered product arrange by turns between separators which were able to wind up a cathode and an anode.

[0020]In the cell according to claim 8, invention concerning Claim 11 is formed, when two or more layers of an electrode layered product arrange by turns between separators which folded up a cathode and an anode.

[0021]
[Mode for carrying out the invention]This invention persons reached this invention, as a result of examining wholeheartedly a desirable adhesion method of an electrolyte layer (separator) and an electrode plate. Namely, a thing about the adhesives 8 which join the cathode 1, the separator 7, and the anode 4 and the separator 7 when this invention manufactures a cell characterized by comprising the following.

The cathode 1 which pasted up the positive active material layer 3 on the positive pole collector 2 as shown in drawing 1.

The electrode layered product 9 of composition of having joined the separator 7 which holds an electrolysis solution between the anodes 4 which pasted up the negative electrode active material layer 6 on the negative pole collector 5.

[0022]The feature of this invention is in a presentation of the adhesives 8 on which the electrodes 1 and 4 and the separator 7 are pasted up, and the adhesives 8 contain an organic vinyl compound which contains two or more vinyl groups in one molecule.

[0023]About how this invention person is in a rechargeable battery, reliability is secured with a thin shape, and charge and discharge efficiency is made high in a temperature requirement wide moreover, By using an organic vinyl compound which contains two or more vinyl groups in one molecule as the adhesives 8, as a result of repeating various researches, Arbitrary form-izing, such as a thin shape, was possible, reliability was secured, it found out that charge and discharge efficiency

could produce a high rechargeable battery in a temperature requirement wide moreover, and this invention was completed.

[0024]Namely, in order that according to this invention person's research this organic vinyl compound may carry out crosslinking polymerization with heating and may harden by using an organic vinyl compound which contains two or more vinyl groups in one molecule as the adhesives 8, It is thought that the adhesives 8 have also secured ion conductivity when an ingredient which the adhesives 8 gelled including an ingredient gelled with an electrolysis solution held an electrolysis solution, while being able to have the bond strength which may make a cell unify in a wide temperature requirement.

[0025]To an organic vinyl compound which contains two or more vinyl groups in the above-mentioned one molecule. Divinylbenzene, methacrylic acid ethylene glycol, triethyleneglycol dimethacrylate, A methacrylic acid 1,3-butylene glycol, methacrylic acid 1,6-hexanediol, A mixture which combines compounds, such as a methacrylic acid polyethylene glycol, a methacrylic acid polybutylene glycol, and trimethylolpropane trimethacrylate, or these is usable.

[0026]Also in an organic vinyl compound which contains two or more vinyl groups in the above-mentioned one molecule, it is desirable to use acrylic ester or methacrylic acid ester from a viewpoint of availability and simplicity of handling.

[0027]It is possible to carry out copolymerization of the organic vinyl compound in which only one piece contains a vinyl group in one molecule to an organic vinyl compound which contains two or more vinyl groups in the above-mentioned one molecule, and to also make it paste.

[0028]To an organic vinyl compound which contains one vinyl group in the above-mentioned one molecule. Methyl methacrylate (MMA), ethyl methacrylate, n-butyl methacrylate, Methacrylic acid i-butyl, t-butyl methacrylate, 2-ethylhexyl methacrylate, Cyclohexyl methacrylate, benzyl methacrylate, methacrylic acid isobornyl, A polymer which consists of compounds, such as tetrahydrofurfuryl methacrylate, styrene, VCM/PVC, and acrylonitrile, mixtures which combine these, or these compounds is usable.

[0029]Crosslinking polymerization by heating can be promoted by adding a reaction catalyst to an organic vinyl compound if needed.

Azobisisobutyronitrile, benzoyl peroxide, lauroyl peroxide, etc. are mentioned to the above-mentioned reaction catalyst.

[0030]According to this invention person's research, when lithium salt and an aprotic organic solvent were contained in the adhesives 8, it turned out that a cell charging and discharging characteristic becomes good especially. Although it is unknown for details about this cause, when lithium salt and an aprotic organic solvent are contained in adhesives, it thinks because adhesives 8 self has ion conductivity.

[0031] LiClO_4 , LiBF_4 , LiAsF_6 , LiCF_3SO_3 , LiPF_6 , LiI , LiBr , LiSCN ,

$\text{Li}_2\text{B}_{10}\text{Cl}_{10}$, LiCF_3CO_2 , etc. can be mentioned to the above-mentioned lithium salt.

[0032]As an aprotic organic solvent, propylene carbonate, gamma-butyrolactone, Ethylene carbonate, a tetrahydrofuran, 2-tetrahydrofuran, 1,3-dioxolane, 4,4-dimethyl- 1,3-dioxolane, Diethyl carbonate, dimethyl carbonate, sulfolane, 3-methyl sulfolane, tert-butyl ether, iso-butyl ether, 1,2-dimethoxyethane, 1,2-ethoxy methoxyethane, etc. can be mentioned.

[0033]Besides layer structure of an electrode layered product which pasted an electrode together to a separator as shown by drawing 1 as a structure of a cell, Multilayer structure, such as plate-like coil form structure of

having the two or more layers electrode layered product which involved in an electrode and a separator as shown by a plate-like laminated structure obtained by laminating a two or more layers electrode layered product as shown by [drawing 2](#) or [drawing 3](#), and [drawing 4](#) in the shape of an ellipse, and formed them, can be considered. Since bond strength and high ion conductivity were secured, an armor can firm as a cell of multilayer structure is not needed, but a multilayer-structure cell whose cell capacity it is compact, and is highly efficient, and is big is obtained.

[0034]

[Working example] Although an embodiment and a comparative example are given to below and this invention is explained to it in more detail, this invention is not limited to these. Using what is explained to [drawing 1](#), fundamental composition of a cell in this examples 1-24 and the comparative examples 1-3 measures bond strength and a cell charging and discharging characteristic of this cell, and shows them in Table 1 with a presentation of adhesives used for this example and a comparative example.

[0035] Adhesives intensity of a cell measured peel strength of a specimen (10mmx100mmx0.2mm) which pasted the cathode 1, the anode 4, and the separator 7 together with each adhesives 8. To test equipment, it measured using Oriental Baldwin UTMII-20 at speed-of-testing 4 mm/min, measurement temperature of 25 **, and 70 **. A cell charging and discharging characteristic is the method indicated, for example in a cell manual (Maruzen Heisei 2(1990) issue edited by a cell manual member-of-editorial-board meeting), and was measured on condition of the following.

charge: -- a constant current + constant voltage anodizing process and upper-limit-voltage 4.2V discharge; constant current lower-limit-voltage 2.5V current value: -- 33.3-mA charge-and-discharge-efficiency = -- discharged electric capacity of which electric capacity / charge was done

[0036]

[Table 1]

		電着剤組成							接着強度		電泳充満 維持性
		MMA	EGDM	HDDM	PEGDM	TMPTMA	電解液	PMMA	正極一 ポリアクリル	負極一 ポリアクリル	
実 例	1	75	25						○	○	○
	2	50	50						○	○	○
	3	25	75						○	○	○
	4	0	100						○	○	○
	5	75		25					○	○	○
	6	50		50					○	○	○
	7	25		75					○	○	○
	8	0		100					○	○	○
	9	75			25				○	○	○
	10	50			50				○	○	○
例	11	25			25				○	○	○
	12	0			100				○	○	○
	13	75				25			○	○	○
	14	50				50			○	○	○
	15	25				75			○	○	○
	16	0				100			○	○	○
	17	50	50				50		○	○	●
	18	50	50				100		○	○	●
	19	50	50				200		○	○	●
	20	50	50				300		○	○	●
比 較 例	21	50	50				400	50	○	○	●
	22	50	50				400	100	○	○	●
	23	50	50				400	200	○	○	●
	24	50	50				400	300	○	○	●
比 較 例	1	MMA							△	△	○
	2	スチレン							×	×	×
	3	ポリフッ化ビニリデン							△	△	○

[0037]Embodiments 1-4.

<Production of a cathode> It applied adjusting the positive-active-material paste which adjusted graphite powder 8weight % 87weight %, and adjusted polyvinylidene fluoride for LiCoO₂ to 5weight % to 300

micrometers in thickness with a doctor blade method, and the active material film was formed. The aluminum network with a thickness [used as the positive pole collector 2] of 30 micrometers was put on the upper part, further, it adjusted to 300 micrometers in thickness with the doctor blade method, and the positive-active-material paste was applied to the upper part. This was neglected for 60 minutes in a 60 °C dryer, it changed into the half-dry state, and the layered product was formed. The cathode 1 which laminated the positive active material layer 3 to the positive pole collector 2 was produced by rolling this layered product so that it may be set to 400 micrometers. When the bond strength of the positive active material layer 3 and the positive pole collector 2 was measured after making an electrolysis solution immerse this cathode 1, 25 °C showed 20 gf/cm and 70 °C showed the value of 15 gf/cm.

[0038]<Production of an anode> It applied adjusting the negative-electrode-active-material paste which adjusted mesophasic-microbeads carbon (made by Osaka Gas) 95weight %, and adjusted polyvinylidene fluoride to 5weight % to 300 micrometers in thickness with a doctor blade

method, and the active material film was formed. The band-like copper net with a thickness [used as the negative pole collector 5] of 20 micrometers was put on the upper part, further, it adjusted to 300 micrometers in thickness with the doctor blade method, and the negative-electrode-active-material paste was applied to the upper part. This was neglected for 60 minutes in a 60 °C dryer, it changed into the half-dry state, and the layered product was formed. By rolling this layered product so that it may be set to 400 micrometers, the anode 4 which laminated the negative electrode active material layer 6 to the negative pole collector 5 was produced. When the bond strength of the negative electrode active material layer 6 and the negative pole collector 5 was measured after making an electrolysis solution immerse this anode 4, 25 °C showed 12 g/cm and 70 °C showed the value of 7 g/cm.

[0039]<Preparation of adhesives> Methacrylic acid ethylene glycol (it carries out abbreviated to EGDM hereafter), and methyl methacrylate. It mixed with the number of weight sections as showed (it carries out abbreviated to MMA hereafter) in the above-mentioned table 1, and the adhesives in which 1 Eq of azobisisobutyronitrile was dissolved to 100 Eq of the mixture were produced.

[0040]<specimen production of an adhesive strength test> -- the porous polypropylene sheet (the Hoechst make.) used as the separator 7 After having applied to trade name Celgard #2400 the adhesives which prepared [above-mentioned], having carried out hot press at 80 °C for 2 hours after pasting together so that the cathode 1 and the anode 4 which were produced there may be stuck and it may become prescribed thickness, and carrying out crosslinking polymerization of the adhesives, it started in predetermined size.

[0041]<production of a cell> -- the porous polypropylene sheet (the Hoechst make.) cut down to 55 mm squares After pasting together so that the adhesives which prepared [above-mentioned] may be applied to both sides of the separator 7 which consists of trade name Celgard #2400, the cathode 1 and the anode 4 may be stuck there and it may become prescribed thickness, hot press was carried out at 80 °C for 2 hours, and the electrode layered product was obtained. After inserting this electrode layered product in the aluminum laminate film bag furthermore and making an electrolysis solution impregnate under decompression, the film like battery (size: 50mmx50mmx0.4mm) was produced by performing obturation processing with heat sealing.

[0042]Replace with the adhesives in Embodiment 5 - the 8. above-mentioned embodiments 1-4, and Methacrylic acid 1,6-hexanediol. It mixed with the number of weight sections as showed (it carries out abbreviated to HDMM hereafter), and MMA in Table 1, and the cell and the bonded specimen were produced like the above-mentioned Embodiments 1-4 using the adhesives in which 1 Eq of azobisisobutyronitrile was dissolved to 100 Eq of the mixture.

[0043]Replace with the adhesives in Embodiment 9 - the 12. above-mentioned embodiments 1-4, and it mixes with the number of weight sections as showed a methacrylic acid polyethylene glycol (it carries out abbreviated to the following PEGDM), and MMA in Table 1, The cell and the bonded specimen were produced like the above-mentioned Embodiments 1-4 using the adhesives in which 1 Eq of azobisisobutyronitrile was dissolved to 100 Eq of the mixture.

[0044]Replace with the adhesives in Embodiment 13 - the 16. above-mentioned embodiments 1-4, and Trimethylolpropane trimethacrylate. It mixed with the number of weight sections as showed (it carries out abbreviated to TMPTMA hereafter), and MMA in Table 1, and the cell

and the bonded specimen were produced like the above-mentioned Embodiments 1-4 using the adhesives in which 1 Eq of azobisisobutyronitrile was dissolved to 100 Eq of the mixture.

[0045] Replace with the adhesives in Embodiment 17 - the 20. above-mentioned embodiments 1-4, and TEGDM, It mixes with the number of weight sections as showed MMA and an electrolysis solution (the Mitsubishi Chemical make, trade name Sol Wright, $\text{LiPF}_6/\text{EC}:\text{DEC}=1:1$ 1

mol/l) in Table 1, The cell and the bonded specimen were produced like the above-mentioned Embodiments 1-4 using the adhesives in which 3-Eq azobisisobutyronitrile was dissolved to 100 Eq of mixtures of TEGDM and MMA.

[0046] Replace with the adhesives in Embodiment 21 - the 24. above-mentioned embodiments 1-4, and TEGDM, MMA, an electrolysis solution (the Mitsubishi Chemical make, trade name Sol Wright, $\text{LiPF}_6/\text{EC}:$

$\text{DEC}=1:1$ 1 mol/l), It mixes with the number of weight sections as showed the poly methyl methacrylate (it carries out abbreviated to PMMA below) of the average molecular weight 1 million in Table 1, The cell and the bonded specimen were produced like the above-mentioned Embodiments 1-4 using the adhesives in which 3-Eq azobisisobutyronitrile was dissolved to 100 Eq of mixtures of TEGDM, MMA, and PMMA.

[0047] It replaced with the adhesives in the comparative example 1. above-mentioned embodiments 1-4, and the cell and the bonded specimen were produced like the above-mentioned Embodiments 1-4 using the adhesives in which 1 Eq of azobisisobutyronitrile was dissolved to 100 Eq of MMA.

[0048] It replaced with the adhesives in the comparative example 2. above-mentioned embodiments 1-4, and the cell and the bonded specimen were produced like the above-mentioned Embodiments 1-4 using the adhesives in which 1 Eq of azobisisobutyronitrile was dissolved to 100 Eq of styrene.

[0049] It replaced with the adhesives in the comparative example 3. above-mentioned embodiments 1-4, and the cell and the bonded specimen were produced like the above-mentioned Embodiments 1-4 using the mixture of polyvinylidene fluoride 5 weight section of the average molecular weight 180000, and N-methyl-2-pyrrolidone (it carries out abbreviated to the following NMP) 95 weight section.

[0050] Using the bonded specimen obtained by the above-mentioned embodiment and the comparative example, the bond strength of adhesives was judged on the standard of following O, x, and **, and the result was shown in the above-mentioned table 1.

O : -- also setting 70 ** 25 ** to which temperature -- bond strength -- case **: more than the bond strength between the active material layer 3 and the 6-charge collector 2 and 5 -- at one of temperature 25 ** 70 **, bond strength -- case x: of less than the bond strength between the active material layer 3 and the 6-charge collector 2 and 5 -- the case where 25 ** of bond strength [70 ** of] is less than the bond strength between the active material layer 3 and the 6-charge collector 2 and 5 also at which temperature [0051] Using the cell obtained by the above-mentioned embodiment and the comparative example, charge-discharge was repeated 100 times, the charging and discharging characteristic was judged on the standard of following -, O, and x, and the result was shown in the above-mentioned table 1.

- : -- the case where the charge and discharge efficiency of an O:100 cycle eye is not less than 70% when the charge and discharge efficiency of a 100 cycle eye is not less than 90% -- case charge and discharge efficiency of a x:100 cycle eye cannot measure by exfoliation of less than 70% or a cell

[0052]According to the Embodiments 1-24, the bond strength between the cathode 1-separators 7 and between the anode 4-separators 7 is large, and the cell excellent in the cell charging and discharging characteristic is obtained as clearly shown in the result of the above-mentioned table 1.

[0053]Production of an embodiment 25. anode and a cathode and preparation of adhesives are performed like the above-mentioned Embodiment 1. After having applied the adhesives of the separator of two sheets prepared on one side, respectively, inserting and sticking the anode between the adhesive application sides of the separator of two sheets and pasting together, hot press was carried out at 80 °C for 2 hours, NMP of adhesives was evaporated, and the anode was joined between the separators of two sheets.

[0054]The separator joined on both sides of the anode was pierced in the predetermined size, the adhesives which prepared [above-mentioned] were applied to one field of this pierced separator, the cathode pierced in the predetermined size was pasted together, and the layered product joined to the separator, the anode, the separator, and the cathode at order was formed. The adhesives which prepared [above-mentioned] were applied to the whole surface of the separator joined on both sides of another anode pierced in the predetermined size, and this another spreading side of the separator was pasted together to the field of the cathode of the above-mentioned layered product pasted together previously. This process was repeated and the battery body which has an electrode layered product of two or more layers was formed, and it dried, pressurizing this battery body, and the plate-like laminated-structure battery body as shown in [drawing 2](#) was produced.

[0055]The above-mentioned plate-like laminated-structure battery body was electrically connected for the collecting tab linked to the end of the cathode of this plate-like laminated-structure battery body, and each negative pole collector in parallel cathodes and by carrying out anodes spot welding. After inserting this plate-like laminated-structure battery body in the aluminum laminate film bag and making an electrolysis solution impregnate like the above-mentioned Embodiment 1, obturation processing was carried out and the cell of multilayer structure was obtained.

[0056]In this example, stick a cathode by the same method as the above between the separators of two sheets, paste together, and adhesives are applied to the whole surface of the separator which sandwiched the cathode. An anode may be pasted together to a spreading side and the process of pasting together another separator which pasted the cathode together between the separators of two sheets on this anode may be repeated further.

[0057]Production of an embodiment 26. anode and a cathode and preparation of adhesives are performed like the above-mentioned Embodiment 1. After having applied the adhesives prepared on one side of each band-like separator of two sheets, inserting and sticking the band-like cathode between this applied field and pasting together, hot press was carried out at 80 °C for 2 hours, NMP of adhesives was evaporated, and the cathode was joined between the separators of two sheets.

[0058]Inserted the anode which applied the adhesives which prepared the cathode to one field of the band-like separator joined in between, made the field of one of these medium, and cut the end of the above-mentioned separator in the predetermined size at specified quantity bending and a fold, it was made to pile up mutually, and it let it pass to the laminator. Then, the adhesives prepared to the field of another side of the above-mentioned band-like separator are applied, The anode previously inserted

into the fold and another anode cut at the predetermined size in the position which counters are pasted together, A part gone half round winds up the above-mentioned band-like separator in the shape of an ellipse so that this may be inserted, It dried having repeated the process of winding up the above-mentioned separator, having formed the battery body which has an electrode layered product of two or more layers, and pressurizing this battery body pasting another anode together, and the plate-like coil form laminated-structure battery body as shown in [drawing 3](#) was produced.

[0059]It electrically connected in parallel by carrying out spot welding of the collecting tab linked to the end of each negative pole collector of this plate-like coil form laminated-structure battery body. This plate-like coil form laminated-structure battery body was made to impregnate an electrolysis solution like the above-mentioned Embodiment 1, obturation processing was carried out, and the multilayer rechargeable battery was obtained.

[0060]Although the example pasted together on both sides of two or more anodes of a predetermined size in between was shown by this example, winding up what joined the band-like cathode between band-like separators, On the contrary, the method of pasting together on both sides of two or more cathodes of a predetermined size in between may be used, winding up what joined the band-like anode between band-like separators.

[0061]Although how to wind up a separator in this example was shown, the method of pasting together on both sides of the predetermined cathode or anode of a size in between may be used, folding up what joined a band-like anode or cathode between band-like separators.

[0062]Production of an embodiment 27. anode and a cathode and preparation of adhesives are performed like the above-mentioned Embodiment 1. A band-like cathode is arranged between the separators of two band-like sheets, the outside of one separator is made to project in fixed quantity, and a band-like anode is arranged. Beforehand, the prepared adhesives are applied to the field of the outside of the separator which arranges the inside field and anode of each separator. A fixed quantity of ends of the anode were preceded and it let it pass to the laminator, and through band-like laminated material was formed in the laminator, piling up an anode, a separator, a cathode, and a separator subsequently. Then, the adhesives prepared to the field of the outside of the separator of another side of band-like laminated material are applied, Bend and paste together to this spreading side the anode made to project, and the laminated material laminated so that this bent anode might be wrapped in inside is wound up in the shape of an ellipse, The battery body which has an electrode layered product of two or more layers as shown in [drawing 4](#) was formed, and it dried, pressurizing this battery body, the anode, the separator, and the cathode were joined simultaneously, and the plate-like coil form laminated-structure battery body was produced.

[0063]The electrolysis solution was injected into this plate-like coil form laminated-structure battery body like the above-mentioned Embodiment 1, obturation processing was carried out, and the cell was obtained.

[0064]Although the band-like cathode is arranged between band-like separators and the example which arranges and winds up an anode on the outside of one separator was shown by this example, the method of arranging a band-like anode between band-like separators, and arranging and winding up a cathode on the outside of one separator conversely, may be used.

[0065]In the above-mentioned Embodiments 25-27, when various the numbers of laminations were changed, cell capacity increased in

proportion to the number of laminations.

[0066]

[Effect of the Invention]As mentioned above, according to invention concerning Claims 1-3, they are the adhesives for cells which paste up the active material layer pasted up on the charge collector on a separator, Since this organic vinyl compound is heated, carries out crosslinking polymerization and hardens when these adhesives contain at least one kind of organic vinyl compound which contains two or more vinyl groups in one molecule, The height of the adhesive property between the electrode-separators in a wide temperature requirement and the charging and discharging characteristic of a cell can be realized, reliability is secured with a thin shape in a wide temperature requirement, and a cell with it can be obtained. [high charge and discharge efficiency and] [practical moreover]

[0067]According to invention concerning Claim 4, the crosslinking polymerization by heating can be promoted by being what mixes a reaction catalyst to the organic vinyl compound which contains two or more vinyl groups in one molecule.

[0068]According to invention concerning Claim 5, when lithium salt and an aprotic organic solvent are contained in adhesives, a cell charging and discharging characteristic becomes good especially.

[0069]By forming the electrode layered product which pastes up a separator on inter-electrode [one pair of] using the adhesives for cells according to any one of claims 1 to 5 according to invention concerning Claims 6 and 7, Reliability is secured with a thin shape in a wide temperature requirement, and it can be considered as a cell with it. [high charge and discharge efficiency and] [practical moreover]

[0070]According to invention concerning Claims 8-11, by having the two or more layers above-mentioned cell layered product, an armor can firm as multilayer structure is not needed, but it can be considered as the cell whose cell capacity it is compact, and is highly efficient, and is big.

[Translation done.]